REMARKS / ARGUMENTS

Pursuant to a request of the Examiner communicated in a telephone conference with the undersigned on or about February 15, 2007, the Examiner is respectfully reminded of her decision then to remove the "Final" status of her Oct. 30, 2006 Office Action. The undersigned communicated to the Examiner by telephone at about that time that the original claims 8 - 11 were not amended by the Amendment of August 15, 2006 in response to the First Office Action, and that pursuant to Manual of Patent Examining Procedure ("M.P.E.P.") Section 706.07(a), because the Examiner had introduced a new ground for rejection of the pending, unamended claims 8 - 11, it would be appropriate to make this second office action of Oct. 30, 2006 non-final. The Examiner communicated to the undersigned that Applicants should treat the Oct. 30, 2006 Office Action as if it was non-final, and Applicants have acted accordingly. The undersigned extends his appreciation to the Examiner for her courtesy and generous expenditure of time in expeditiously resolving this matter by her decision to make the Oct. 30, 2006 Office Action non-final.

In response to the second office action of October 30, 2006, Applicants have amended the only independent claims, claims 1 and 8, and presented remarks below to resolve concerns raised by the Examiner. Reconsideration and allowance of the specification and pending, amended claims are respectfully requested.

I. Invention Overview

The invention is a vacuum fuel cell procedure and system for starting up a fuel cell by applying a vacuum to an anode flow field and then using a rapid fuel purge of the anode flow field to minimize corrosion of a carbon catalyst support layer by a reverse current mechanism produced by movement of a fuel-air front through the anode flow field. A vacuum source applies a vacuum to the anode flow field while the fuel cell is shut down, while a fuel inlet valve and a fuel exhaust valve are closed, and just prior to admitting fuel to the anode flow field. The resulting vacuum within the anode flow field produces a rapid purge of the fuel through the anode flow field upon start up, and the vacuum may also remove essentially all of the air within the anode flow field to virtually eliminate movement of the fuel-air front, thereby minimizing any resulting corrosion.

II. Response to Office Action

In the Oct. 30, 2006 second office action, the Examiner has rejected all pending claims. This response will address the concerns of the examiner in the order in which they appear within the office action.

First, at Section 3 of the second office action, the Examiner has rejected claims 1-5, 7-9, and 11 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,358,637 to Fuss (hereafter "Fuss") in view of U.S. Patent Publication No. 2002/006583 to Reiser et al. (hereafter "Reiser"). The Examiner points out that a lot of the elements of the pending claims are

found in those two references, and concludes in essence: "Fuss discloses the shut down procedure to shut down the cell comprising the steps of closing the fuel inlet valve and the fuel outlet valve to prohibit the flow of fuel through the anode flow field..., then applying a vacuum to the anode flow field..., then opening the fuel inlet valve and the fuel outlet valve, then delivering a continuous flow of hydrogen fuel into the anode flow field, then delivering a flow of oxidant into the cathode flow field...."

Applicants respectfully disagree that Fuss shows "applying a vacuum to the anode flow field" that establishes a rapid fuel purge as the fuel is directed to flow through the anode flow field. To clarify distinctions between Applicants' pending method claims 1 - 7 and apparatus claims 8 - 11, the present Amendment has added clarifying language to both independent claims 1 and 8. In particular, independent method claim 1 has been amended to establish that the vacuum applied to the anode flow field is done so as part of a start up procedure, so that a substantial pressure differential is established between the fuel within the fuel inlet valve and the anode flow field as the fuel is permitted to flow through the anode flow field. Antecedent basis for this amendment is found in the Specification at page 11, lines 8 - 12. Additionally, independent apparatus claim 8 has been similarly amended to further describe and limit the "vacuum source means" to include establishing a substantial pressure differential between the fuel inlet valve and the anode flow field "just prior to flow of

the fuel into the anode flow field". Antecedent basis for this amendment is found in the Specification at page 11, lines 8 - 12, and at page 8, lines 3 - 10 for the "just prior" aspect of the amendment to claim 8.

It is respectfully urged that Fuss fails to disclose or suggest application of a vacuum as part of a start up procedure as now claimed in independent claim 1 as now amended. Further, Fuss fails to disclose or suggest a vacuum source means as now claimed by independent claim 8 as now amended. In contrast to Applicants' claimed invention, Fuss discloses application of a vacuum upon shut down of a fuel cell to remove water from the fuel cell in freezing ambient conditions to limit damage to the fuel cell from freezing water within the fuel cell. (See Fuss at Col. 2, lines 29 - 34.) Fuss stresses that removal of such water from the fuel cell is only practical while the plant is warm, immediately after shutdown, or while the plant is being warmed "during evacuation" for the purpose of removing water by the vacuum immediately after shutdown. (Id. at Col. 3, lines 3 - 17.)

In particular, in the chart of the Fuss Figure 2, Fuss shows the absolutely enormous pressures necessary to evaporate water as temperatures approach freezing. Therefore, because Fuss teaches application of a vacuum to remove water from a fuel cell while the fuel cell is warm shortly after the cell is being shut down in sub-freezing ambient conditions, it is apparent that Fuss does not teach application of a vacuum prior to start

up of such a frozen fuel cell, because that could not remove water from the fuel cell and therefore would not achieve the goal of Fuss. By the present amendment to Applicants' only independent claims to clarify that application of a vacuum to Applicants' vacuum fuel cell system is part of a start up of a fuel cell that achieves a substantial pressure differential between the fuel within the fuel inlet valve and the anode flow field as the fuel enters the anode flow field, it is respectfully urged that Applicants' claims as now amended are thoroughly distinct over the teachings of Fuss.

It is stressed again that Fuss is a shut down system and apparatus for removing water prior to freezing of a fuel cell. While the undersigned appreciates the Examiner's observation that Fuss teaches directing hydrogen and oxygen through the fuel cell after application of the vacuum to start up the fuel cell, nothing in Fuss suggests application of the vacuum after shut down while the fuel cell is frozen, for as explained above, that could not achieve the goal of Fuss. Moreover, it is also respectfully urged that Fuss does not teach nor suggest maintenance of a vacuum during the shut down period. Again, there is no possible benefit to maintenance of the vacuum during shutdown because the Fuss fuel cell is shut down in sub-freezing ambient conditions, so there would be no concern about movement of water into or out of the Fuss fuel cell during sub-freezing ambient conditions. As recited above, Fuss is concerned to remove as much water as possible prior to exposing the fuel cell to sub-freezing conditions.

Not only does Fuss lack any specific teaching that a vacuum is maintained during shut down of the Fuss fuel cell, but also Applicants insist that it would not be obvious to one of ordinary skill in the art that Fuss could maintain such a vacuum. Attached to this Amendment is a Declaration of one of ordinary skill in the art, who is also a co-inventor of the present Application. The Declaration establishes that the Fuss fuel cell does not show nor suggest maintenance of a vacuum during a shut down period and prior to start up to achieve the now claimed pressure differential and consequent rapid fuel purge of the anode flow field of the present invention.

Therefore, and more importantly, Fuss does not show nor suggest a vacuum fuel cell system that through use of a vacuum apparatus or through application of a vacuum establishes a specific pressure differential between the fuel at an inlet valve and an anode flow field of between about 31.5 kPa and about 105.5 kPa, as now required by the present independent claims 1 and 8, as amended.

Consequently, Applicants insist that Fuss fails to teach or suggest application of a vacuum or use of a vacuum source means as now claimed in independent claims 1 and 8 as amended, and that therefore Fuss fails to teach or suggest all of the claimed limitations of the present invention. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." (M.P.E.P, Sec.

2143.03.) Therefore, it is respectfully requested that Fuss be removed as a reference and that independent claims 1 and 8 as amended by the present Amendment be allowed.

It is noted that all of the Examiner's rejections of the remaining dependent claims likewise rely upon Fuss in combination with other references. It is urged that Fuss be removed as a reference in rejecting those dependent claims as well, and that dependent claims 2 - 7 and 9 - 11 therefore be allowed. Additionally, "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." (M.P.E.P. Sec. 2143.03.) It is urged that the dependent claims be allowed for this reason as well.

III. Conclusion

By the present amendment to independent claims 1 and 8, and by the discussion presented above it is respectfully urged that all of the Examiner's concerns raised in her October 30, 2006 first office action have been resolved. Accordingly, it is respectfully requested that the Examiner remove the rejections of the pending claims, and issue a Notice of Allowance.

Respectfully submitted,
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Date: 3/30/07

Application No.	:	10/749,971	Confirmation No. 9671
Applicant	:	KULP, Galen W.	
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Docket No.	:	C-2884	
Declaration Dated	:	3/26 2007	

DECLARATION RESPONSIVE TO OCTOBER 30, 2006 SECOND OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

RICHARD D. BREAULT declares as follows:

1. I am experienced in design and manufacture of fuel cells. I have worked for UTC FUEL CELLS, LLC (and its predecessors-in-interest) of South Windsor, Connecticut, U.S.A. for over 40 years. I am a patentee of over 65 fuel cell patents. I am also a joint inventor of the subject matter disclosed in the above referenced patent application.

2. Therefore, I am one of ordinary skill in the art.

3. I have reviewed U.S. Patent 6,358,637 B1 to Fuss (herein after, "Fuss").

4. Fuss shows application of a vacuum as part of a shut down procedure for a proton exchange membrane fuel cell to evaporate and remove a portion of the water within the fuel cell while the inlet and outlet valves of the fuel cell are closed,

and prior to permitting the fuel cell to cool below freezing temperatures. This is accomplished in Fuss by operating a vacuum pump during the shut down procedure.

5. Fuss, however, does not teach maintaining a vacuum within the fuel cell during the shut down period or prior to restarting the fuel cell. There would be no reason for Fuss to maintain the vacuum within the fuel cell during shut down because a desired quantity of water was evaporated from the fuel cell prior to the completion of the shut down procedure. Maintaining such a vacuum during the shut down period would require operating a vacuum pump during the shut down period which would require expenditure of energy; or would require designing a sophisticated and expensive seal configuration which could sustain a vacuum for several days without operation of a vacuum pump.

6. A typical proton exchange membrane fuel cell used in transportation applications contains approximately 40 inches of fuel seals and 40 inches of oxidant seals per cell. A typical fuel cell stack contains about 200 cells or a combined seal length of 16,000 inches of seals per a fuel cell stack. Fuel cell stacks used in transportation applications will be shut down for periods consisting of hours (over-night) to several days (weekends). It would be very difficult and costly to incorporate a sophisticated seal configuration which could sustain a vacuum for several days without operation of a vacuum

pump when there are 16,000 inches of seals per stack. The cells are interconnected by reactant manifolds within the fuel cell stack such that a leak in a single cell will result in a loss of a vacuum in every cell, therefore Fuss does not show or suggest maintaining a vacuum during shut down of the fuel cell, or applying a vacuum prior to start up of the fuel cell.

The declarant hereby declares that all statements made herein of the declarant's own knowledge are true and that all statements made on information and belief are believed to be true. The declarant further states that the above statements were made with the full knowledge that willful false statements and the like are punishable by fine and/or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statements may jeopardize the validity of this application or any patent resulting therefrom.

Richard D. Breault Date: 3/26/07

Richard D. Breault